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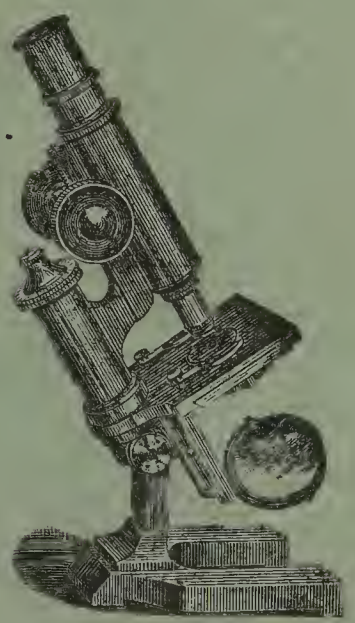
THE

MICROSCOPICAL BULLETIN

AND

SCIENCE NEWS



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February 4, 1897.

Editor Microscopical Bulletin:

Dear Sir:—Enclosed please find 25 cents for renewal of my subscription to the Bulletin.

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H. M. FARR, M. D.

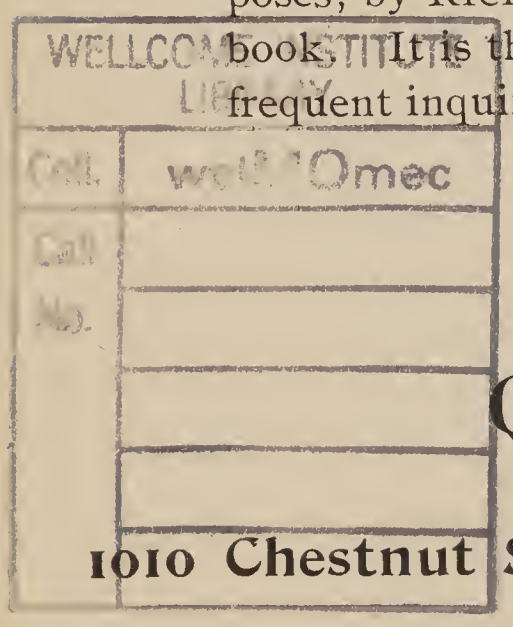
THE THOMAS A. SCOTT FELLOWSHIP IN HYGIENE, UNIVERSITY OF PENNA.

The Scott Fellowship in Hygiene at the University of Pennsylvania falls vacant October 1st, 1897. Individuals desirous of applying for appointment to the position can obtain details of the governing regulations by communicating with Prof. A. C. ABBOTT, Director of the Laboratory of Hygiene, University of Pennsylvania, Philadelphia.

Two New and Important Books for the Medical Microscopist

A Manual of Clinical Diagnosis, by means of Chemical and Microscopic Methods, for the use of students, hospital physicians and practitioners. By CHAS. E. SIMON, M. D. In the absence of an English edition of von Jaksch this book stands now pre-eminent as a manual of Clinical Diagnosis. Price, **$3.50**

The Clinical Examination of the Blood for Diagnostic Purposes, by RICHARD C. CABOT, M. D. We can heartily recommend this book. It is the first work of the kind in English, and we realize from frequent inquiries of late that such a manual has been needed. Price, **$3.75**



P. BLAKISTON, SON & CO., Inc.

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THE MICROSCOPICAL BULLETIN AND SCIENCE NEWS.

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All communications should be addressed to the Editor of MICROSCOPICAL BULLETIN, *1010 Chestnut Street, Philadelphia.*

NOTES AND COMMENTS.

The BULLETIN enters upon its 14th volume with a renewed desire to occupy still more completely an important niche in the world of microscopy. To those who have followed its career during these 13 years this statement needs no explanation. Briefly stated, however the BULLETIN wishes to present to the busy worker points regarding the theory and practical manipulation of his instrument, ideas as to the mounting and preparing of his specimens, notes and comments upon contemporary work in the sciences and arts directly allied to microscopy, and information as to new instruments and materials. All this to be done in a sufficiently pointed and concise manner to be read and utilized by all who see the publication. To this end the BULLETIN prefers to remain a small and unostentatious journal, laying no great claims as to originality or exhaustive treatises. Brief ababstracts from the many foreign and other periodicals bearing directly upon the use of the microscope, which many of our readers have neither the time or opportunity to examine, will remain a principal feature.

A serious difficulity confronts the editor in the execution of this plan, arising from the two distinct channels into which microscopical research has been diverted in the past few years. In the early days of the BULLETIN it was largely to the interest and aid of the amateur to which both the editor and the optican must lend himself. The present universal adoption of the microscope in medical diagnosis and professional biologic research has created a demand, not only for another distinct class of literature but another line of apparatus and supplies.

Realizing therefore that it is perhaps in the professional field that the microscope is being used to the most advantage, the BULLETIN will endeavor to publish much matter of interest to its medical and other professional friends. This does not mean that articles of interest to the general amateur worker will be omitted. We know that the present wide use of the instrument is largely due to the amateur's enthusiasm, and that he is still often the first to recognize and support any earnest endeavor on the part of the optician to improve the instrument and its various accessories.

Readers will therefore confer a favor upon all by freely offering criticisms and suggestions as to the BULLETIN itself, queries and answers, which will be answered as far as possible in another column, and short contributions regarding their own experience and work which, while perpaps seemingly commonplace to themselves will surely be of value to a less experienced worker. If at the end of the volume the BULLETIN has induced only a few microscropists to create or support any microscopical yearning in the mind of a novice, or has been the means of a professional or amateur worker doing more careful and fruitful research its mission for the year will have been accomplished.

* * *

The Academy of Natural Sciences, of Philadelphia, will confer the Hayden Memorial award for 1896, upon Prof. Giovanni Capellini, of Bologna. His work in Geology and Paleontology has earned him honors and recognition from many of the leading Societies and Universities in this country, and in Europe. The Hayden Memorial Fund was established by Mrs. Emma W. Hayden, in memory of Prof. Fred. V. Hayden, M. D., L.L. D., and is awarded annually for the best publication, exploration, discovery or research in the sciences of Geology and Paleontology.

Prof. Alex. C. Abbott, M. D., director of the laboratories of Hygiene in the University of Pennsylvania, has recently been appointed Chief of the Bacteriological Division, of the Philadelphia Board of Health, in place of Dr. B. Meade Bolton, resigned.

* * *

Dr. S. Austin Davis of Bayonne, N. J., has very kindly prepared and sent to us an index to the MICROSCOPAL BULLETIN, volumes IX to XII inclusive, which is now being printed. It will be mailed upon completion to all subscribers. Our subscribers will doubtless join us in sincerely thanking Doctor Davis for his valuable work.

* * *

Dr. Chas. Warden Stiles, of the Bureau of Animal Industry, Department of Agriculture, Washington, has received from the State Department, the appointment as special commissioner to report on the parasitic diseases of real life.

* * *

It is announced that the Rush Medical College, of Chicago, has secured the services of Dr. Klebs, the distinguished German pathologist. Dr. Klebs will also be connected with the post-graduate Medical School of Chicago University.

RAPID AND CONVENIENT METHOD OF PREPARING MALARIAL BLOOD-FILMS.

Dr. P. Manson describes, in the *British Medical Journal*, the following method of preparing blood-films:

Well-cleaned slides are placed in rows on a table near the patient. Three or four oblong slips of fine tissue-paper 1½ by ⅝ in. are also prepared. The droplet of blood, about 1-16 in. in diameter, is then taken up by touching it with one of the papers about ½ in. from the end of the paper. The charged surface is then placed upon a slide rather towards one end. When the blood has run out into film, but not before, the paper is drawn along the surface of the glass. The same paper is usually sufficient for several glasses, and when exhausted should be recharged. In this way 50-60 films may be prepared in 5 or 6 minutes. Labels may then be attached and the slides stored away. Before proceeding to stain, the blood is fixed by dropping a little absolute alcohol on the films. After drying they are stained with borax 5 per cent., methylen-blue ½ per cent., for about half a minute. They are then washed and dried, and mounted in balsam.—*Journal of the Royal Microscopical Society.*

THE INFLUENZA BACILLI.

A recent number of the *Centrallblatt für Innere Medicin* contains a notice of some further investigations by A. Pfuhl and K. Walter, on the presence of the influenza bacilli in the central nervous system. Pfuhl's previous identification of these bacilli in the central nervous system and his contention that they are always to be found there in cases of influenza which have ended fatally, have received confirmation from these researches. It is however pointed out that along with the influenza bacillus large and small streptococci, as well as bacteria, associated with putrefaction, are found. As the colonies of influenza bacteria isolated from the central nervous system only develop very sparsely in artificial culture media, and might easily escape recognition in the presence of other bacteria, Messrs. Pfuhl and Walter recommend that their cultivation should be carried out on perfectly clear agar agar, the condensed water of which has been got rid of by keeping it in a slanting position for two or three days in the incubator, after which human or pigeon's blood is spread over the surface. It is best to discard tubes and employ instead, dishes or plates, so as to increase the surface area of the culture material, and the latter should be perfectly inoculated by making several streaks with a very fine platinum needle containing the substance to be examined. In this manner all the colonies which subsequently develop can be closely watched under the microscope, and the identification and isolation of the influenza bacillus is materially assisted. That the influenza bacillus, and not the other bacteria found with it, is the actual cause of the disease, has been shown by Nanweak, who described a case which ended fatally where influenza bacteria and no other varieties were present in the nervous system.—*Nature.*

TESTS FOR MICROSCOPE OBJECTIVES.

In the *English Mechanic*, Mr. E. M. Nelson mentions the following as useful test-objects. A "spread slide" of *P. angulatum*, dry on the cover, for objectives of ½ in. and upwards with a ¾ axial cone. For higher powers the *N. rhomboides* as found in "Sozodont" tooth powder is an excellent test. For low powers a balsam mounted diatom with dark ground illumination by Abbe condenser and central stop is recommended.

THE EFFECTIVENESS OF APERTURE.

BY HENRY ORFORD, PHILADELPHIA.

(*Second paper.*)

In figure 1. O is an object mounted in balsam and the hemisphere the front of a

dry lens. The oblique rays are refracted at the front surface of the cover glass to where shown in the diagram, which encloses an

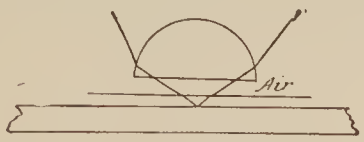

FIG. 1.

angle of about 160° and all rays beyond 83° (about), are reflected back by the cover glass.

Now fill the space between the cover glass and the plane of the front lens with a liquid, having approximately the same refraction as the front lens of the system (see figure 2)

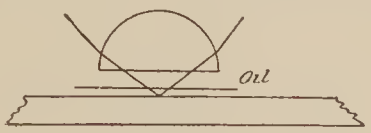

FIG. 2.

and the cover glass. There will be now practically no refraction at all, and a far greater cone of light can now enter the lens (the maximum amount being 180° in theory). We greatly gain in illumination by the fact explained by Clausius, that the radiant energy emitted by any body increases as the square of the refractive index. For example, if we saw through an atmosphere of 1.51 about the density of cedar oil, instead of air with its density of 1. images would appear brighter by 9.4.* In figure 3,

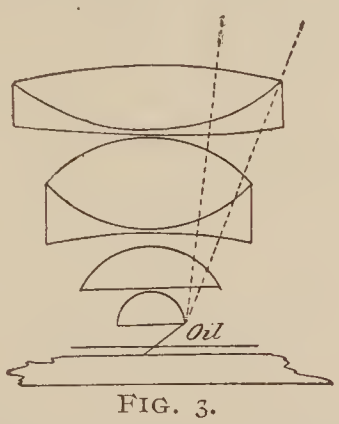

FIG. 3.

we have a diagram of a large angle system and note the enormous difference between it and figure 5, figure 3, is a homogeneous system

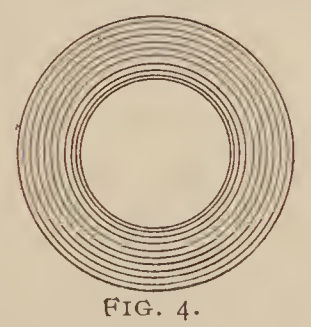

FIG. 4.

of rather larger aperture than 1.30 N.A. and figure 5, a large (almost the largest) practical aperture of a dry lens. One can see at a glance from the diagram the great amount of light that can be obtained with the homogenous system, for all over the inner dotted line is clear gain and as aperture is resolution, it is manifest that the abolition of refraction between the cover glass and the anterior lens of a system is conducive to this great gain, and also makes the lens

* Philos. Trans.

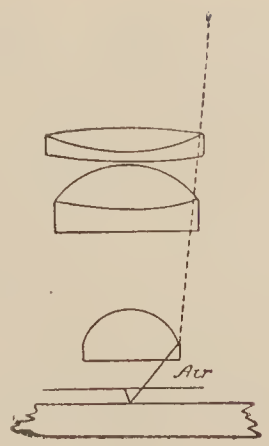

FIG. 5.

obviously independent of cover glass correction. In a lens of the same aperture as that in diagram 3, when looking through the lens from the universal screw end, that is from the posterior surface holding the objective up before a large window, (or near to) it will be noticed that from the edge of the back setting a ring of grey light appears. Now without measuring the aperture by any apparatus or contrivances, the approximate aperture can be at once told by the diameter of the bright spot surrounded by this greyish light, (we shall see later the cause of it) and unless any lens has more than an aperture of 1. N.A., this ring of light does not appear, and an aperture of 1.1 N.A. only just shows it. If we look at diagrams 3 and 4 we shall see (through different systems) that to make a dry lens of figure 3, all the extra diameter of the back lenses could be cut away and no gain could be made by having the system composed of four parts, for to get critical definition, the second lens would have to be separated from the correcting lenses, and it is obvious that a single lens of longer curvature would fullfill these conditions better, hence a system as figure 5 is used. As to telling nearly the aperture by glancing through a system, (preferably through a magnifier)—examine the posterior system. This should show an image of the front lens perfectly, and the larger the aperture the smaller the image is seen, so that if we had a system of about 1.51 N.A. (the extent of aperture where used with a medium of cedar oil 1.516) the front lens should appear but slightly larger from the back of the system though surrounded by an immense band of greyish light. In the case of diagram 3, this system would show the bright bead slightly over twice the diameter of the front, Fig. 4.

This is a way to tell somewhere near the aperture of a wide angle lens. In a dry lens we see no ring of light, and aperture is hard to tell without actual measurement, though on a microscope a test object will soon tell you its effectiveness, if not its real aperture. Of course, I am speaking from a maker's experience. Measure of aperture and numerical apertures we reckon by the Abbe method. Professor Abbe explained that the very angle of an aperture was not necessarily the angle subtended by the edge of the plane front.

Some rays of that angle might never get through the back, and it is just as possible that a large back lens might not be filled by the cone admitted by the front, so that the angle depended upon the effective opening as compared with the focal length.* Now, why did the Professor choose the "semi angle" as his measure and express this angle by its sine? Let us remember that we are dealing with the actual effective opening or width of the lens, ideally concentrated in a plane at the focal distance from an object, O, Fig. 6. It is as if the whole lens was concen-

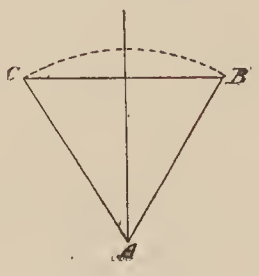

FIG. 6.

trated in a circular plane whose diameter is the line A A at the focal distance O S. The "angle" then is A O A.† Describe the arc A C A from O, then A S is the sine of the semi-angle or "sin," u. It will be manifest that, in comparing lenses, these sines, A S, will be in just the same ratios as doubles of sines, or A A. But such double of the sine is the diameter of the aperture or actual circle which gathers the cone of rays, and the squares of such diameters give areas of these circles and tells us the respective measures of illumination. As the refractive index, expressed by n, that also is a ratio of sines and can be expressed in no other way. Obviously, the number expressing the index for water or oil compared with 10 for air, gives us the respective value of similar "cones" in those media. Hence the formula of (N A = n sin u(means no more nor less than that effective "aperture" arc measured by the comparative actual diameters of the pencils compared with the focus and reckoned, if necessary, with respect to air, by the index of the medium in which the angle is measured. This is the simple meaning of numerical "aperture," which we owe to Prof. Abbe. Fig. 6 also shows in what way this mode of measuring differs from degrees of arc. The angle A O A is drawn as 60°; which shows that A S, or "sin u," is half the radius of the arc which measures angle. Let the angle be 180°, then the centre of the arc will be at S, and the sine A S of 90° will equal the radius or = 1. Thus three times the angle only gives us an "aperture" of double the diameter in this case. In general, mere inspection of the geometrical relation of the sine A S shows us that for low angles the sine or aperture does increase nearly as the arc or angle; but that this state of things gradually alters until, as we approach 90°, a large increase of angle makes very little difference to the sine or aperture.

*See Lewis Wright's Microscopical Images and Apertures,

†For A in diagram 6 read O for C and B, A A, Where the vertical line crosses the horizontal one, S. and vertical line and dotted curve, C.

PRESERVATION OF URINARY DEPOSITS.

Dr. Gumprecht in *Centrallblatt für Innere Medicin* says that after having obtained his deposit with a centrifuge, he places it in a saturated solution of sublimate and centrifuges it a second time. He then washes it and preserves it in a 2 to 10 per cent. solution of formol. In the absence of red blood corpucles the sublimate stage may be omitted. If much albumen is present the deposit should be washed with a normal saline solution. In the case of urates it should be washed with warm water or a saturated solution of boric acid. If permanent mounts are to be made the formol should be entirely washed off. Dr. Gumprecht further states that deposits preserved in this way can hardly be discerned from fresh specimens.

MICROSCOPAL EXAMINATION OF MEALS.

Dr. Lange in the *Zeitschrift für Angewandte Mikroscopie*, says it is possible to distinguish barley-meal from the flour of rye and wheat, owing to the fact that the first contains 2 to 4 per cent. of silica, while the two latter contain only small quantities. And as the silicated plant-cells, such as the husk of seeds, epidermis, and even hairs retain their appearance after combustion and treatment with mineral acids, it is possible to detect their presence even under low powers. The author's method is to put a teaspoonful of the meal to be examined in a flask of hard glass, together with 20 cc. of strong sulphuric acid, and a teaspoonful of anhydrous copper sulphate. Energetic oxidation takes place on boiling, and after complete reduction, a colorless fluid is obtained The fluid is poured slowly into 250 cc. of water in a conical glass, and after having been stirred with a glass rod, is allowed to stand for some hours. Some of the sediment may then be pipetted off and examined under the microscope. This method is said to be quite certain for the detection of barley-meal when mixed with flour and other meals. Of course it can be used for baked articles.—*Journal of the Royal Microscopical Society.*

MESSSRS. QUEEN & CO.'s NEW ONE-SIXTH INCH OBJECTIVE, 0.94 N.A.

BY DR. ALFRED C. STOKES.
TRENTON, N. J.

Messrs. Queen & Co., having done me the honor to send, for examination, the one-sixth

inch objective from their new dry series of wide aperture, I have had the pleasure of using the lens for several evenings.

Perhaps the feature that at once becomes conspicuous, one that will commend itself to any microscopist, is the remarkable flatness of field, which the one-sixth has in common with the new oil immersion one-twelfth. The optician seems to have discovered the secret of combining aperture and flatness of field, with a result that is conspicious and may become important.

The defining power of the objective is excellent. As a test for this there are probably few common objects that excel the domoid membrane which arches above each areolæ of the pygidium from the flea, with the eye of the dome, and the row of minute, upright setæ which stand like sentinels about the border of that opening. These fine structural points appear to elude the objectives, or it may be the eyesight of some of my correspondents, who think they possess, and probably do possess good objectives. But if the reader should be in need of a delicate problem in definition with which to struggle, and to give his objectives of moderate power some what of a task, and his eye-training somewhat of a test, I can recommend the hyaline membrane with its aperture and its appendages, which are to be seen above each of the areolæ that togther form the pygidium. With the new, dry one-sixth, while the image is a little nebulous and slightly milky, it is not to be condemned. The cuneiform projections within the same areolæ, and which are so much used in Europe as a delicate test, are shown sharply defined, although rather pale in color.

Its wide aperture, 0.94 N.A., should give the objective great and brilliant resolving power. As to this the reader can draw his own conclusions from the following.

With daylight from a winter sky, with the concave mirror alone, and central illumination, *Pleurosigma angulatum* in styrax is resolved into dots under the 8 eye-piece; in the same conditions *Surirella gemma* shows its tranverse striæ. Under the winter's weak and watery light, with the mirror 30° from the axis and with eye-piece 8, the objective resolves *Nitschia linearis*, number 16, of the Thum test-plate.

Under central illumination from an achromatic condenser and compensating ocular 5, *Nitschia linearis* is again resolved, and of course with a better image. In the same conditions, but with oblique light, number 17 of the Thum test-plate is well resolved, while ocular 8 reveals the longitudinal striæ of *Surirella gemma*, (number 18) in styrax, and the black dots of *Navicula rhomboides* in Piffard's medium of 1.625 index.

Over the postage-stamp fracture through the secondary membrane of *Isthmia enervis*, even when in Piffard's highly refractive medium, the objective breaks down utterly, at which the reader need not be surprised; indeed he will not experience the slightest emotion if he has ever made the experiment for the test is one of the severest, if not actually the severest known for the resolving power of any objective. The new one-sixth shows that a delicate structure is present, and it points out the extent of the fractured film, but it asks to be excused from anything more of the kind. The secondary structure of *Isthmia nervosa* is a central plate of silica pierced by minute apertures, and held suspended, or at least partly supported within each areola by several tenuous bars. The whole forms an excellent test for an objective of wide angle and moderate power. With the one-sixth the supporting bars are well resolved, and the inter-spaces become bright black, an expression that is not meaningless, however it may seem at the first thought. But the objective will not resolve the minute central perforations in balsam.

THE WIDAL BLOOD TEST FOR TYPHOID BACILLI.

At the meeting of the Academy of Science of St. Louis, on January 4, 1897, Dr. Amand Ravold gave a microscopic demonstration of Widal's test for typhoid fever, demonstrating that after the disease has existed for four days or more the blood of typhoid patients, probably because of some contained antitoxine, possesses the power of inhibiting the motion of typhoid bacilli from a pure culture introduced into it within a period of one hour or less, whereas in normal blood similar bacilli retain their power of locomotion for an indefinite length of time. It was stated that typhoid blood possesses this property even after having been dried for a period of four weeks or more, so that a few drops obtained from a person suspected of having the disease may be sent to suitable places for applying the test, thus rendering comparatively easy the diagnosis of a disease which in its early stages presents many clinical difficulties.—*From report of the meeting in "Science," January 22, 1897, by William Trelease, Recording Secretary.*

PHOTOGRAPHY THROUGH THE MICROSCOPE.

BY JAMES WALLACE, M. D., PHILADELPHIA.

The difficulties that attend the production of a photographic picture of a microscopic object, mainly arise from the fact that each point in the object is represented by hundreds of points in the image. If the magnification is one thousand diameters then each point in the object would be represented by a square, each side of which contained one thousand points, or a total of one million. In order that the pencils of light which diverge from these extremely minute

points should be sharply focused in the image entirely free from diffusion circles, it requires the highest art of the optician in preparing the objective and the most careful attention of the microscopist to the nature of the illumination, and the centreing of the entire apparatus. In this manner the limits of photo-micrography can be very widely extended, both in respect to the extent of the magnification and the size of the field. It is obvious that if we could limit the light which emanates from every point in an object to a very small bundle of rays we would have a sharp image. In the photographic objective this is done by stopping down the lens. Then even with a poor objective we obtain a sharp picture. When we come to the microscope, however we cannot do this so well, partly because we must have a great deal of light to compensate for the enlargement and partly because the objectives on account of their proximity to the object, take in a very broad cone of rays. If a condenser of very short focus produces the image of a flame on the object the divergence of the rays after forming the image will be relatively very great. A wide angle lens will take these nearly all in and the illumination of the microscopic image will be very great, but the definition will be poor. If a longer focus condenser forms an image of a smaller luminous body the divergence of the rays will be very much less and the microscopic image will be marked by increased definition. Thus we have reached the first essential of photo-micrography which is to diaphragm the light. This is very easily done, by placing around the lamp, or gas flame, a chimney of sheet-iron with a circular aperture. This aperture should be so arranged that different sized orifices can be produced at pleasure.

Two methods offer themselves for obtaining this. First an iris diaphragm fitted in the whole gives a complete series of a pertures at pleasure and is probably the best. Second a rotary dial with various sizes of holes can be made to revolve around the opening. It is of great importance that the luminous source should be a circular aperture. The manner in which I discovered this may be interesting to relate. I had a slit made to obtain the interference bands produced by wave systems in opposite phases, I placed this before my lamp and was much struck by the distinctness that it gave to the image on on the camera from the microscope. On developing the plate the lines were found to be distinct, only in one direction. In the direction at right angles, to this they were very much blurred, substituting a small circular aperture instead of the slit I was enabled to obtain a picture sharp and clear in all meridians, covering an 8x10 plate. This agrees entirely with our proposition that the distinctness of the image diminishes as the size of the luminous source increases and increases as the size of the luminous source diminishes.

Next to obtaining a circular aperture in the source of light comes focusing the aperture by the condenser. The light source that I use is a Welsbach, it would be impossible to focus the incandescent mantle on account of its texture. Lamp flames are not even in their intensity, some parts are almost white and others are of an orange. This would make a difference in the density of the negatives and prove a source of annoyance. By having the aperture about two inches from the flame a pretty even illumination can be obtained when we have a sharp clear border of the aperture focused on the slide. It is convenient to focus the aperture by making it smaller than we desire, so that we can see it all in the field; then after focusing it we can enlarge it to suit. The circle of light on the slide should be no larger than the field that the microscope takes in. No increase in illumination is obtained by making it any larger and some loss in definition always follows. Much may be allowed for individual peculiarities but it seems to me that a condenser is better when its focus is rather long, of course its angle will be diminished, but I am sure that the light obtained by my own is too strong for any one to look at comfortably through the microscope. It is composed of a tube four inches long with an achromatic lens of four inches focus at the end towards the light and an achromatic lens of two inches focus in the end towards the object. Such a condenser is entirely free from the microscope, it passes through a collar in a brass plate, five inches square, so that its distance from the light can be regulated. A vertical adjustment in centreing is obtained by a screw, and a horizontal adjustment by means of a rack and pinion. The condenser and Welsbach burner are mounted on a sliding-board which can be brought closer to the microscope or removed according as the focusing requires. A still finer adjustment of focus is obtained by sliding the tube in the collar.

The apparatus for photo-micrography in order to be properly centred requires an optical bench. There are three principal parts in this system, beginning from one end and going towards the other. The camera, the microscope and and the light and condenser. To get these all in line both vertically and horizontally is very important to the success of the picture. Much vexation and delay arise from a faulty apparatus in which the centreing of the different parts can not be readily effected. My own apparatus is so very convenient that a brief description of it may afford some hints to others.

Any apparatus employed must be largely dependent on the ideas and requirements of the one who uses it, for its ultimate con-

struction; modifications to suit particular requirements, must be incorporrated in the general plan of arrangement.

The first thing about the apparatus that should be decided on is the size of the camera to be employed and the style of microscope. Most people will be best satisfied with a small camera. Queen & Co. sell one with a plate about five inches square. This is an admirable size and shape; the microscope forms a circular picture on the plate, an oblong plate is therefore a waste, and is not suited to microscopic work. The microscope is to be used in the horizontal position; it should therefore have such a base that when the tube is turned into the horizontal position the microscope will not tip over. The camera, microscope and illuminating apparatus are now to be arranged together. As they all slide to and from each other, or at least the camera and illuminating apparatus must be capable of being brought closer to the microscope or removed from it, for a camera with a five inch plate an extension should be allowed of from ten to fifteen inches; for the microscope a space about ten inches should be allowed, and for the illuminating apparatus about eighteen inches. This altogether would approximate four feet in length. Accordingly, an oak board ten inches wide, four feet long, and one inch thick will form a very good base to work on. Along each side there is to be placed a runner one inch high. This keeps all the parts of the apparatus in line after they have been once centered. The tube of the microscope is turned into the horizontal position and verified by a spirit level. The height of the center of the eye piece is now determined; the center of the ground glass plate of the camera must be raised to the same height by raising the board on which the camera is screwed, on strips of wood that have a rabbet cut into them to adapt them to the runners on the under board. The easiest way to center the microscope is to take a circular board about ten inches in diameter and cut out a place for the base of the microscope to stand in. The microscope is now illuminated and the circle is thrown on the ground glass of the camera; by twisting and sliding the wooden circle from side to side the circle of light on the screen is made to occupy a position equally distant from any two opposite sides, that is above and below, right and left. It should now be screwed down on the under board and will always be in center when placed in the frame, provided it is pushed all the way down. The Welsbach light can be mounted like a student's lamp on a short, thick rod of iron, on which the height can be changed by a set screw and which can be swung around the rod so as to bring it in center. The chimney will very advantageously rotate on the Welsbach light, giving still further means of centering. When the well centred and well illuminated image is brought on the screen the final touch requisite is the focusing. This may be done by carefully looking at the image on the ground glass screen, either with the unaided eye or with a magnifying glass, and altering the adjustment until all the lines become fine. A perfectly focused image is sometimes almost invisible if the structure is delicate. The ground glass is an annoyance by dispersing the image, especially if a magnifying glass is used. This may be remedied by greasing the ground glass, or even by wetting it, then it becomes almost homogeneous. But the best way of all to focus is to take off the ground glass plate and catch the aerial image with a convex lens. If the eye is placed at the focal distance of the lens it will receive rays from every part of the lens and the image will be very brilliant and can easily be focused. It is of no particular consequence whether you focus exactly on the plane where the plate will be, an inch or so either way makes no palpable difference, although it is more methodical to focus as nearly as possible where the plate will be placed. The eye piece may be left out of the microscope in photographing, or it may be very advantageously employed. Without an eye piece to obtain 1,000 diameters with a $\frac{1}{12}$ immersion lens would require an extension in the camera of 83 inches. With a 2 inch eye piece the same effect could be obtained with an extension of 18 inches. A photographic eye piece should have the tube so arranged that the distance between the field lens and the ocular can be altered. When the objective is faulty the field lens subdues the errors by diminishing the size of the image, if it is removed from the ocular. With other lenses a better effect is obtained by approximating the field lens and ocular. The question of exposure is one that must be settled individually. One rule will be found very satisfactory. Always have the developer the same strength, and let that be less than the normal developer, and then the illumination being equal, after the time has once been determined that gives the best negative, it should be adhered to.

THE MICROSCOPE IN THE SCHOOLS.

We extract and heartily endorse the following from an article in the December, '96, *Observer:* "*The Kindergarten and the Microscope*," by Dr. Geo. C. Taylor of Polydras, La.

* * * * *

"As an educator the microscope should be in every school of the land, from the university down to the kindergarten, with the adjunct of an instructor especially adapted to each special grade of school. The university should have the highest microscopical talent obtainable. The instructor in the kindergarten should be pre-eminently endowed with the happy faculty of especially adapting the work of the instrument to the capacity and intelligence of the little ones.

While the latter position does not require the expert *technique* of the university professor of microscopy, it is one more difficult to fill perhaps, than that of the university professor."

* * * * *

"Our people need a good microscopical shaking up ; yes, shaking up till they realize that a school without a microscope is as sad a view as one without a dictionary. Why is it that our superintendents of public education do not introduce the instrument into every public school of the land?"

HOW TO OBTAIN ARBORESCENT CRYSTALS OF SILVER.

BY F. W. RICHARDS, MONTREAL, CANADA.

Take a small piece of nitrate of silver, *lunar caustic*, place it on an excavated slide with with a few drops of water for a minute, remove undesolved portion, (it may be used again),bend a thin piece of copper wire so that one end dips into the solution, have microscope in upright position, place upon stage and view as an opaque object, with light condensed by bull's eye ; beautiful feathery crystals of pure silver will be seen growing upon the copper, varying in shape and size according to strength of solution.—*The Observer.*

CHANGE IN THE STAFF OF THE AMERICAN NATURALIST.

At the close of the thirtieth volume of *The American Naturalist*, Prof. J. S. Kingsley, of Tufts College, and Prof. C. O. Whitman, of the University of Chicago, withdrew from the board of editors. Dr. F. C. Kenyon, of Philadelphia, takes the place of Prof. Kingsley as managing editor, with Prof. E. D. Cope. The *Naturalist* has, in its long history, witnessed unparalled advances in the biological sciences, and will continue to be an important factor in the further progress that is assured.—*Science.*

REMARKS ON THE ENDING OF NERVES IN MUSCLE TISSUE, WITH DEMONSTRATIONS.

BY G. C. HUBER

The following is an abstract from a paper read at the ninth annual meeting of the American Physiological Society held in Boston and Cambridge, December 29 and 30, 1896.

The method used in preparing the sections was the following : A 2 per cent. solution of methylen blue in normal salt solution was injected into a vein. Sometime after the injection the tissues were exposed and developed in the air. As soon as the motor endings were recognized in the fresh muscle, the tissues were fixed in ammonium molybdate (Bethe), dehydrated in alcohol, embedded in paraffine, and sectioned. The sections were then fixed to a slide, stained in alum carmine and mounted in balsam. In order to determine with some degree of certainty the relation of the end-organs to the muscle fibres, the latter were cut in both horizontal and cross-sections. The conclusions are as follows :

A. Voluntary muscle (rabbit). The granular sole is an accumulation of sarcoplasma at the point of entrance of the nerve ; the nuclei of the sole are nuclei of the sarcoplasma. The axis cylinder of the motor nerve ends in an end-brush in the sarcoplasma. The neurilemma becomes continous with the sarcoplasma.

B. Heart muscle (cat and dog). Axis cylinders of sympathetic ganglion cells terminate *on* the heart muscle cells either as very simple endings, namely, one or two very fine end-branches which terminate in small granules or bulbs, or in somewhat more complicated end-organs composed of several small twigs, these usually ending also in the bulbous enlargement.

C. Involuntary muscle (cat, rabbitt and tortoise). The ending here is very simple. The terminal branches of the axis cylinders course along between the involuntary muscle cells, giving off in their course very fine side branches which end on the cells often near the nucleus.—*Science.*

BOOKS RECEIVED.

Elementary Zoology and Laboratory Guide.—By Professors Henry E. Chapin and Louis J. Rettger. G. P. Englehard & Co., Chicago, received from the authors.

In courses where sufficient time is not provided for lectures to supplement laboratory work in Zoölogy, in the way of intelligent instruction in classfication, this book will assuredly meet the requirements. A chapter is devoted to each branch of Zoölogy, each chapter ending with a laboratory guide to the examination of various types of the Class in hand. These types are chosen so as to afford the instructor a wide range in the choice of his laboratory material, thus commending the work to use under greatly varying conditions. Points of especial significance relating to the theory of evolution are carefully brought out, though space is not used in elaborate description of obscure forms now prominent in biologic controversy. The use of the book as clearly outlined by the authors, can but accomplish their idea of imparting to the student a clear conception of Zoölogy in its systematic as well as morphological aspect.

A Guide to the Organic Drugs of the U. S. Pharmecopœia, 1890.

Compiled and arranged by Jno. S. Wright. A pocket edition containing brief accounts of organic drugs, a conspectus of the natural orders of plants mentioned, a glossary of the botanical and therapeutical terms used, and an index of botanical synonyms. Published and sent gratis to students in pharmacy by the Eli Lilly Co., Indianapolis, Ind. Received from the publishers.

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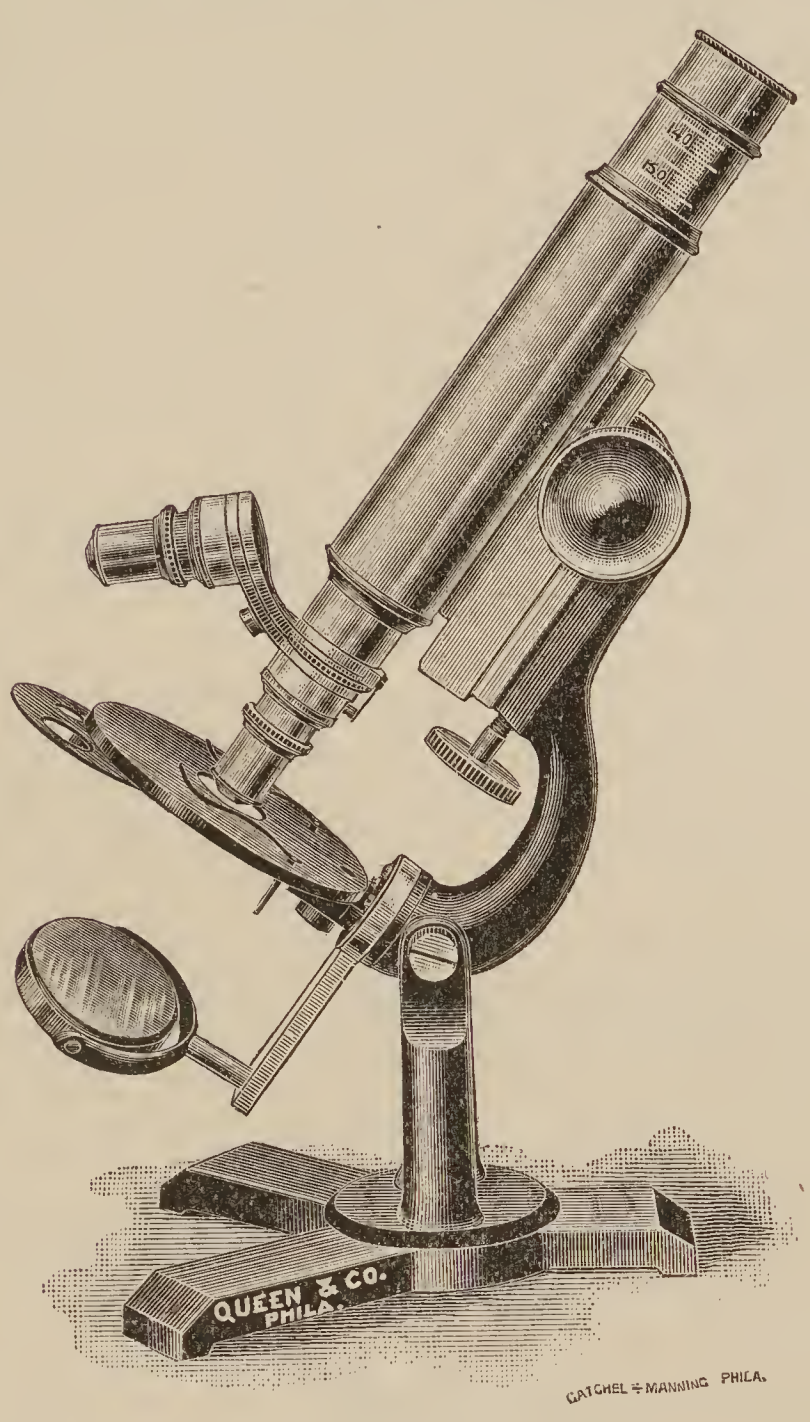

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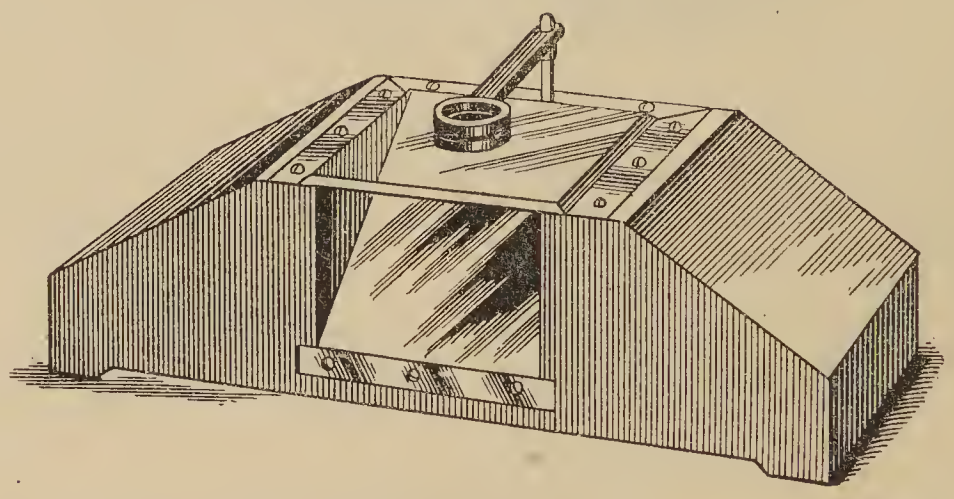

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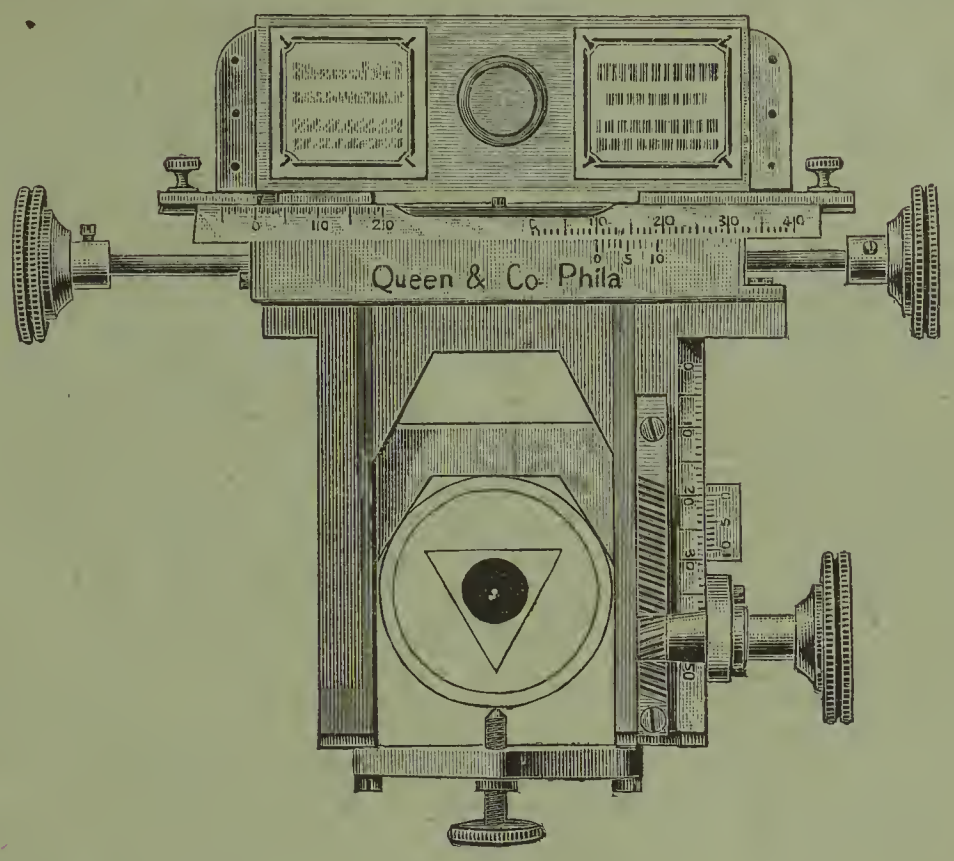

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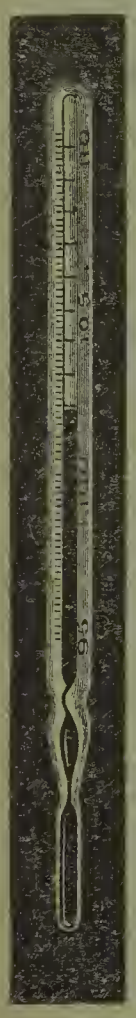

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